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T H E

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THE SONGS OF THE GRASSHOPPERS.

BY S. H. SCUDDER.



ALTHOUGH every one is familiar with the notes of birds, few can distinguish the different chirpings of insects, or are even aware that every kind of Grasshopper has its distinctive note. The songs of insects are neither so varied nor complicated as those of birds, but their study presents peculiar difficulties. Sounds become inaudible to many persons when they are derived from vibrations more rapid than 25,000 per second, and when the number reaches 38,000, the limit of human perceptibility is attained: thus, the shrillness of a note may prove a hinderance to its study. This is illustrated by Tyndall in his recent book on Sound. He writes: "Crossing the Wengern Alp with a friend, the grass on each side of the path swarmed with insects, which, to me, rent the air with their shrill chirruping. My friend heard nothing of this, the insect world lying beyond his limit of audition."

Another and universal obstacle lies in the delicacy or feebleness of the notes of some species; to distinguish them

clearly, one must bring his ear to within a few feet, or even inches of the insect during its stridulation,—a process which requires great caution lest the shyness of the little violinist should overcome his egotistic love of song. The observer must walk quietly toward the sound until it ceases, and wait motionless for its renewal; the direction of the chirping can then easily be determined, although its distance is deceptive. After drawing an imaginary line towards the spot from whence the sound proceeds, cautious steps must be taken around the arc of a wide circle until another line is fixed at right angles to the first, and the location of the songster approximately determined. Then walking quickly but quietly to within five or six feet of the insect, the observer will fall upon his hands and knees, and produce a quill edge and file, which, on being rubbed together, imitate, with great exactness, the desired note. He will commence his mock stridulation after a short delay; at first the sounds must be subdued and separated by considerable intervals, then loud, and repeated in quick succession; usually a response is heard before a minute has elapsed, and sometimes it comes at once. When the insect has forgotten his fears and begins to stridulate violently, the observer may cease operations and carefully approach him. In this way one can place himself within a few inches of any species living in the grass.

Grasshoppers stridulate in four different ways: first, by rubbing the base of one wing-cover upon the other, using, for that purpose, the veins running through the middle portion of the wing; second, by a similar method, but using the veins of the inner part of the wing; third, by rubbing the inner surface of the hind legs against the outer surface of the wing-covers; and fourth, by rubbing together the upper surface of the front edge of the wings and the under surface of the wing-covers. The insects which employ the fourth method stridulate during flight,—the others while at rest. To the first group belong the Crickets; to the second

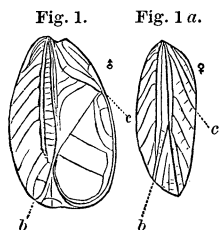
the Green or Long-horned Grasshoppers; to the third and fourth, certain kinds of Short-horned or Jumping Grasshoppers. The sounds produced by the different groups vary in pitch, those of the crickets being shrillest and the others following in the order just given. With but few exceptions the males alone sing.

The notes of the Cricket—called by the French “cri cri” on account of its song—may be heard near Boston* from the middle of June until November; further north they do not appear until much later in the season. Their note is *errri*, and the rapidity with which it is uttered varies even in the same strain; sometimes it is as slow as two notes a second, at others it is twice as rapid. The note is sharp and shrill, and appears to be pitched at E natural, two octaves above middle C. Sometimes two choirs of these insects may be heard at once, the individuals of each choir chirping simultaneously, but one choir more rapidly than the other; most of the time this produces a sort of discord, but, as they occasionally harmonize, one hears cycles of accordance and discordance, often of remarkable uniformity and duration.

The Spotted-cricket (*Nemobius vittatus*) appears simultaneously with the Black-cricket (*Gryllus niger*). The chirping of the two insects is very similar, but that of the former may be better expressed by *r-r-r-u*, pronounced as though it were a French word. The note is trilled forcibly, and lasts a variable length of time. One of these insects was once observed while singing to its mate. At first the song was mild and frequently broken; afterwards it grew impetuous, forcible, and more prolonged; then it decreased in volume and extent until it became quite soft and feeble. At this point the male began to approach the female, uttering a series of twittering chirps; the female ran away, and the male, after a short chase, returned to his old haunt, singing with the same vigor but with frequent pauses; at last, finding all persuasion unavailing he brought his serenade to a close.

* All my illustrations are drawn from New England insects.

In September and October, the White Climbing-cricket (*Ecanthus niveus*, Fig. 1, left wing-cover of male, Fig. 1 *a*, the same of female*) is found on the leaves of low trees and bushes. It makes a uniform note, exceedingly shrill but attenuated.



The peculiar development of the wing in stridulating Orthoptera is nowhere seen to better advantage than in this insect.

In the female, the veins of the central field run nearly parallel to the border; in the male, they cross the wing in various directions, and either converge toward the point of stridulation on the inner border of the wing, where the inner and central fields meet, or act as supports to the converging veins.

All these insects belong to the first class. There are many species in the second group (the green or long-horned grasshoppers), but a few examples will suffice. These insects, like the crickets, sing both by day and night, but, unlike the latter, their day-song differs from that of the night. On a summer's day, it is curious to observe these little creatures suddenly changing from the day to the night-song at the mere passing of a cloud, and returning to the old note when the sky is clear. By imitating the two songs in the daytime, the grasshoppers can be made to respond to either at will; at night, they have but one note.

The previous illustrations showed that the stridulating organ of crickets occupied the middle field of the wing; in the green grasshoppers, on the contrary, it will be found in the inner field; here, too, the relative size of the inner field is nearly the same in both sexes, but the stout, curved vein of the male is altogether wanting in the voiceless female.

One of them, the *Phaneroptera curvicauda* (Fig. 2, male;

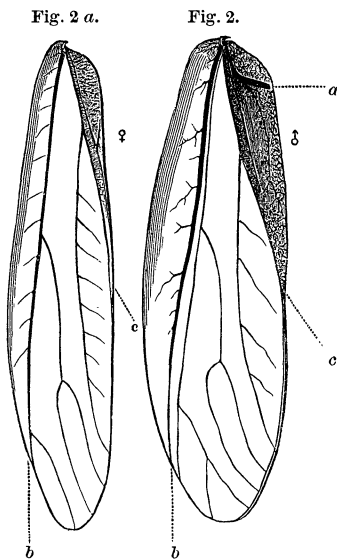
* In all the illustrations, the dotted lines show the limitations of the different fields of the wing; *a* represents the "file;" *b* points at the line of separation between the costal (or outer) and central fields; *c*, at that point between the central and inner fields.

Fig. 2 *a*, female), prefers to sing in the night. His day-song is *bzrwī*, and lasts one-third of a second; the night-song consists of a repetition—ordinarily eight times—of a note which sounds like *tchw*. This is repeated at the rate of five in three-quarters of a second, making each note one-half as long as that of the day.

The song of the common Meadow-grasshopper (*Orchelimum vulgare*) is more complicated. Commencing with *ts*, it changes almost instantly into a trill of *zr*: at first there is a crescendo movement which reaches its volume in half a second; the trill is then sustained for a period varying from one to twenty seconds, and closes suddenly with *p*. This strain is followed by a series of staccato notes, sounding like *jip*; they are one-eighth of a second in length, and are produced at one-half second intervals. The staccato notes and the trill alternate *ad libitum*. The night-song differs from that of the day simply in its slower movement; the pitch of both is at B flat, two octaves above middle C.

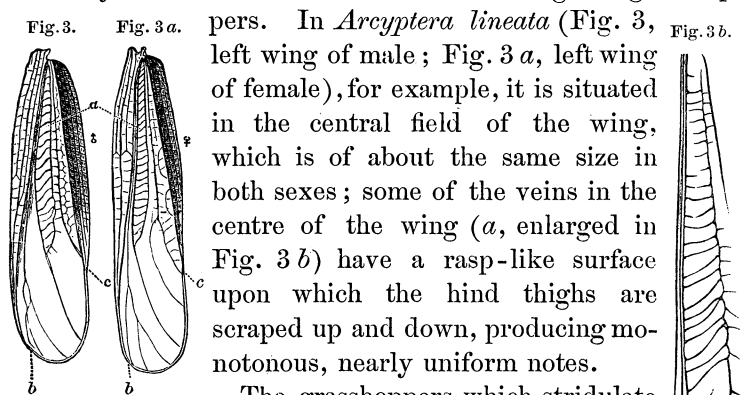
A conical-headed grasshopper (*Conocephalus robustus*), found near the seashore in the southern part of New England, makes the salt marshes resound with its incessant, shrill din. The resemblance of its song to that of the harvest-fly is quite striking; at a distance, the note seems to be perfectly uniform; close at hand, one can hear it rising and falling rhythmically, two and a half times a second, accompanied by a loud droning noise.

There are numerous kinds of jumping grasshoppers which stridulate in the daytime only. They do this by the aid of



the hind legs, rubbing their thighs against their wing-covers; every movement of the fiddle-bow produces a short note, and the uniformity with which each species plays its own song is quite remarkable. One kind (*Stenobothrus curtippennis*) produces about six notes per second, and continues them from one and a half to two and a half seconds; another (*S. melanopleurus*) makes from nine to twelve notes in about three seconds. In both cases the notes follow each other uniformly, and are slower in the shade than in the sun.


The stridulating apparatus of the jumping grasshoppers is of a very different character from that of the green grasshoppers.



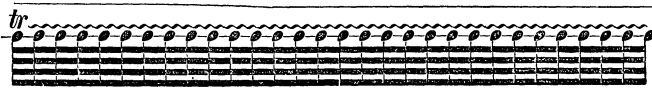
In *Arcyptera lineata* (Fig. 3, left wing of male; Fig. 3 a, left wing of female), for example, it is situated in the central field of the wing, which is of about the same size in both sexes; some of the veins in the centre of the wing (a, enlarged in Fig. 3 b) have a rasp-like surface upon which the hind thighs are scraped up and down, producing monotonous, nearly uniform notes.

The grasshoppers which stridulate during flight, by the contact of the wings and wing-covers, belong mostly to the genus *Ædipoda*; in many of them the wings are variegated with brilliant colors. The sound which they make seems to be under the control of the insects, for they often omit it when alarmed. Some species produce a uniform, rattling noise during the whole of their undeviating flight; others make it only during the intervals of flight, and seem to stridulate more at will. The flight of the latter is more sustained, they are capable of changing their course, and at each turn emit a crackling sound of short duration.


ts----- zr-----



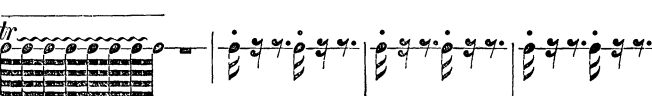
zr-----



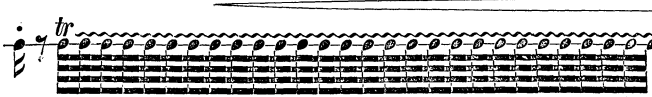
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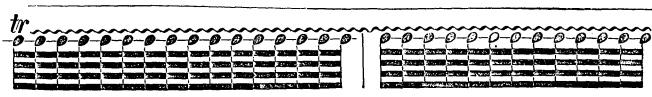
zr-----p jip jip jip jip jip jip




jip ts ----- zr-----



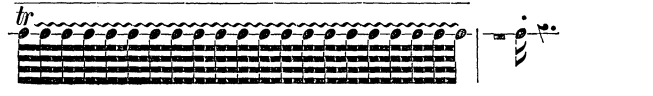
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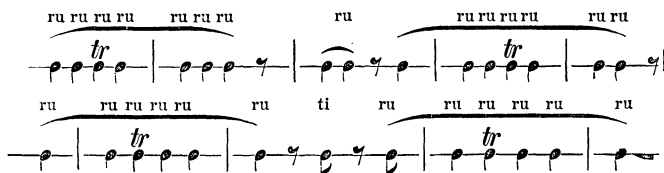
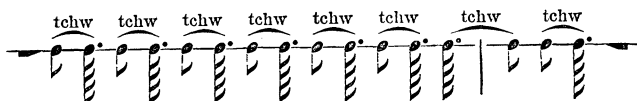
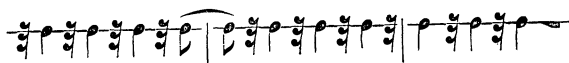
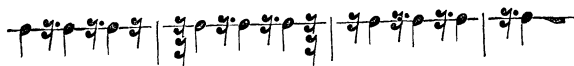
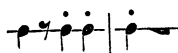


zr-----



zr-----p jip


Note of *Orchelimum vulgare*.

Note of *Gryllus neglectus*.Note of *Nemobius vittatus*.Note of *Phaneroptera curvicauda* by day.Note of *Phaneroptera curvicauda* by night.Note of *Stenobothrus melanopleurus* in the sun.Note of *Stenobothrus melanopleurus* in the shade.Note of *Stenobothrus curtippennis*.Note of *Arcyptera lineata*.